TOPIC: 192006
KNOWLEDGE: K1.01 [2.5/2.6]
QID: P58

Fission products that have large microscopic cross sections for capture of thermal neutrons are called...

A. breeder fuels.

B. burnable poisons.

C. fissionable fuels.

D. reactor poisons.

ANSWER: D

TOPIC: 192006
KNOWLEDGE: K1.01 [2.5/2.6]
QID: P858 (B1858)

Fission product poisons can be differentiated from other fission products in that fission product poisons...

A. have a longer half-life.

B. are stronger absorbers of thermal neutrons.

C. are produced in a larger percentage of fissions.

D. have a higher fission cross section for thermal neutrons.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.01 [2.5/2.6]
QID: P2058 (B2061)

A fission product poison can be differentiated from all other fission products in that a fission product poison...

A. will be produced in direct proportion to the fission rate in the core.

B. will remain radioactive for thousands of years after the final reactor criticality.

C. will depress the power production in some core locations and cause peaking in others.

D. will migrate out of the fuel pellets and into the reactor coolant via pinhole defects in the clad.

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.01 [2.5/2.6]
QID: P2158

A fission product poison can be differentiated from all other fission products in that a fission product poison...

A. will be radioactive for thousands of years.

B. is produced in a relatively large percentage of thermal fissions.

C. has a relatively high probability of absorbing a fission neutron.

D. is formed as a gas and is contained within the fuel pellets and fuel rods.

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.01 [2.5/2.6]
QID: P2858 (B1558)

A fission product poison can be differentiated from all other fission products because a fission product poison...

A. has a higher microscopic cross section for thermal neutron capture.

B. has a longer half-life.

C. is produced in a greater percentage of thermal fissions.

D. is formed as a gas and is contained in the fuel pellets.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.02 [3.0/1.1]
QID: P658

Xenon-135 is considered a major fission product poison because it has a large...

A. fission cross section.

B. absorption cross section.

C. elastic scatter cross section.

D. inelastic scatter cross section.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.02 [3.0/1.1]
QID: P1858 (B1058)

Which one of the following is a characteristic of xenon-135 in a reactor core?

A. Xenon-135 is produced from the radioactive decay of barium-135.

B. Xenon-135 is primarily a resonance absorber of epithermal neutrons.

C. Thermal neutron flux level affects both the production and removal of xenon-135.

D. Thermal neutrons interact with xenon-135 primarily through scattering reactions.

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.02 [3.0/1.1]
QID: P2458 (B1658)

Which one of the following exhibits the greatest microscopic cross section for absorption of a thermal neutron in an operating reactor core?

A. Uranium-235

B. Boron-10

C. Samarium-149

D. Xenon-135

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.02 [3.0/1.1]
QID: P2658 (B256)

Compared to other poisons in the core, the two characteristics that cause Xe-135 to be a major reactor poison are its relatively _________ absorption cross section and its relatively _________ variation in concentration for large reactor power changes.

A. small; large

B. small; small

C. large; small

D. large; large

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P59

Immediately after a reactor trip from sustained high power operation, xenon-135 concentration in the reactor will...

A. increase due to the decay of iodine already in the core.

B. decrease because xenon is produced directly from fission.

C. remain the same because the decay of iodine and xenon balance each other out.

D. decrease initially, then slowly increase due to the differences in the half-lives of iodine and xenon.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P358 (B362)

Xenon-135 is produced in a nuclear reactor by two primary methods. One is directly from fission, the other is from the decay of...

A. cesium-135.

B. iodine-135.

C. xenon-136.

D. iodine-136.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P1359 (B458)

A reactor has been operating at full power for several weeks. Xenon-135 is being directly produced as a fission product in approximately _________% of all fissions.

A. 0.3

B. 3.0

C. 30

D. 100

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P1559 (B859)

Which one of the following lists the production mechanisms of Xe-135 in an operating power reactor?

A. Primarily from fission, secondarily from iodine decay

B. Primarily from fission, secondarily from promethium decay

C. Primarily from iodine decay, secondarily from fission

D. Primarily from promethium decay, secondarily from fission

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P1859 (B257)

The major contributor to the production of Xe-135 in a reactor that has been operating at full power for two weeks is...

A. the radioactive decay of I-135.

B. the radioactive decay of Cs-135.

C. direct production from fission of U-235.

D. direct production from fission of U-238.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: P60

Following a reactor trip from sustained power operation, the xenon-135 removal process consists primarily of...

A. beta decay.

B. gamma decay.

C. electron capture.

D. gamma capture.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: P460 (B462)

Reactor power is increased from 50% to 60% in 1 hour. The most significant contributor to the initial change in core xenon reactivity is the increase in xenon...

A. production from fission.

B. decay to cesium.

C. absorption of neutrons.

D. production from iodine decay.

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: P859

In a shut down reactor, which decay chain describes the primary means of removing xenon-135?

A. $^{135}Xe \xrightarrow{\beta^-} {}^{135}Cs$

B. $^{135}Xe \xrightarrow{n} {}^{134}Xe$

C. $^{135}Xe \xrightarrow{\alpha} {}^{131}Te$

D. $^{135}Xe \xrightarrow{\beta^+} {}^{135}I$

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: P1059 (B359)

Xenon-135 undergoes radioactive decay to...

A. iodine-135.

B. cesium-135.

C. tellurium-135.

D. lanthanum-135.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: P2558 (B2558)

Reactors A and B are operating at steady-state 100% power with equilibrium core Xe-135. The reactors are identical except that reactor A is operating at the end of core life (EOL) and reactor B is operating at the beginning of core life (BOL).

Which reactor has the greater concentration of core Xe-135?

A. Reactor A (EOL) due to the smaller 100% power thermal neutron flux

B. Reactor A (EOL) due to the larger 100% power thermal neutron flux

C. Reactor B (BOL) due to the smaller 100% power thermal neutron flux

D. Reactor B (BOL) due to the larger 100% power thermal neutron flux

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: P2659 (B3358)

A nuclear plant has been operating at 100% power for several months. Which one of the following describes the relative contributions of beta decay and neutron capture to Xe-135 removal from the reactor core?

A. Beta decay and neutron capture contribute equally

B. Primary - beta decay; secondary - neutron capture

C. Primary - neutron capture; secondary - beta decay

D. Not enough information given to make a comparison

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.05 [3.1/3.1]
QID: P61 (B58)

A reactor has been operating at 50% power for one week when power is ramped in 4 hours to 100% power. Which one of the following describes the new equilibrium xenon concentration?

A. The new equilibrium xenon value will be twice the 50% value.

B. The new equilibrium xenon value will be less than twice the 50% value.

C. The new equilibrium xenon value will be more than twice the 50% value.

D. The new equilibrium xenon value will remain the same because it is independent of power.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.05 [3.1/3.1]
QID: P660 (B658)

A nuclear reactor has been operating at 100% power for one week when power is ramped in 4 hours to 50%. Which one of the following describes the new equilibrium core xenon-135 concentration?

A. Remains the same because it is independent of power

B. More than one-half the 100% value

C. Less than one-half the 100% value

D. One-half the 100% value

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.05 [3.1/3.1]
QID: P1158 (B1160)

A reactor has been operating at 25% power for 24 hours following a 2-hour power reduction from steady-state full power. Which one of the following describes the current status of core xenon-135 concentration?

A. At equilibrium

B. Decreasing toward an upturn

C. Decreasing toward an equilibrium value

D. Increasing toward a peak value

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.05 [3.1/3.1]
QID: P1459 (B259)

Following a two-week shutdown, a reactor is taken critical and ramped to full power in 6 hours. How long will it take to achieve an equilibrium xenon condition after the reactor reaches full power?

A. 70 to 80 hours

B. 40 to 50 hours

C. 8 to 10 hours

D. 1 to 2 hours

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.05 [3.1/3.1]
QID: P2159 (B2659)

Which one of the following indicates that core Xe-135 is in equilibrium?

A. Xe-135 production and removal rates are momentarily equal five hours after a power increase.

B. A reactor has been operated at 80% power for five days.

C. Xe-135 is being produced equally by fission and I-135 decay.

D. A reactor is currently operating at 100% power.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.05 [3.1/3.1]
QID: P2859 (B2760)

Reactors A and B are operating at steady-state 100% power with equilibrium core Xe-135. The reactors are identical except that reactor A is operating near the end of core life and reactor B is operating near the beginning of core life.

Which reactor is experiencing the most negative reactivity from equilibrium core Xe-135?

A. Reactor A due to the greater concentration of equilibrium core Xe-135

B. Reactor A due to the lower competition from the fuel for thermal neutrons

C. Reactor B due to the greater concentration of equilibrium core Xe-135

D. Reactor B due to the lower competition from the fuel for thermal neutrons

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P259

A reactor has been operating at 50% power for one week when power is quickly ramped (over 4 hours) to 100%. How will the xenon-135 concentration in the core respond?

A. Decrease initially, then build to a new equilibrium concentration in 8 to 10 hours

B. Increase steadily to a new equilibrium concentration in 20 to 30 hours

C. Decrease initially, then build to a new equilibrium concentration in 40 to 50 hours

D. Increase steadily to a new equilibrium concentration in 70 to 80 hours

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P659

A reactor has been operating at a steady-state power level for 15 hours following a rapid power reduction from 100% to 50% using boration for reactivity control. Which one of the following describes the current core xenon concentration?

A. Increasing

B. Decreasing

C. At equilibrium

D. Oscillating

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P959

A reactor was operating for 42 weeks at a stable reduced power level when a reactor trip occurred. The reactor was returned to critical after 12 hours and then ramped to 60% power in 6 hours.

How much time at steady state 60% power will be required to reach equilibrium xenon?

A. 20 to 30 hours

B. 40 to 50 hours

C. 70 to 80 hours

D. Unable to determine without knowledge of previous power history

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P1258

A reactor has been operating at 100% power for one week when power is ramped in 4 hours to 25% power. The new equilibrium core xenon-135 level will be ____________ the initial 100% equilibrium value.

A. the same as

B. about 80% of

C. about 50% of

D. less than 25% of

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P1360 (B1960)

A reactor has been operating at a steady-state power level for 15 hours following a rapid power reduction from 100% to 50%. Which one of the following describes the current core xenon concentration?

A. Increasing toward a peak

B. Decreasing toward an upturn

C. Increasing toward equilibrium

D. Decreasing toward equilibrium

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P1659

A reactor was operating for 24 weeks at a constant power level when a reactor trip occurred. The reactor was returned to critical after 12 hours and then ramped to 80% power in 6 hours.

Approximately how much time at steady state 80% power will be required to reach equilibrium core xenon-135?

A. 10 to 20 hours

B. 40 to 50 hours

C. 70 to 80 hours

D. Cannot determine without knowledge of previous power history

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P1960 (B1262)

A reactor has been operating at 100% power for two weeks when power is decreased to 10% in 1 hour. Immediately following the power decrease, core xenon-135 concentration will ____________ for a period of ____________.

A. decrease; 4 to 6 hours

B. increase; 4 to 6 hours

C. decrease; 8 to 11 hours

D. increase; 8 to 11 hours

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P2060

A nuclear reactor is initially operating at 50% of rated power with equilibrium core xenon-135. Power is increased to 100% over a one hour period and average reactor coolant temperature is adjusted to 588°F using manual rod control. Rod control is left in manual and no subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes the average reactor coolant temperature 8 hours after the power change is completed?

A. Greater than 588°F and decreasing slowly

B. Greater than 588°F and increasing slowly

C. Less than 588°F and decreasing slowly

D. Less than 588°F and increasing slowly

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P2061 (B2063)

A reactor had been operating at 100% power for two weeks when power was reduced to 10% over a one hour period. In order to maintain plant parameters stable during the next 24 hours, which one of the following incremental control rod manipulations will be required?

A. Withdraw rods slowly during the entire period.

B. Withdraw rods slowly at first, then insert rods slowly.

C. Insert rods slowly during the entire period.

D. Insert rods slowly at first, then withdraw rods slowly.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P2160

A reactor had been operating at 50% power for two weeks when power was increased to 100% over a 3-hour period. In order to maintain reactor power stable during the next 24 hours, which one of the following incremental control rod manipulations will be required?

A. Withdraw rods slowly during the entire period

B. Withdraw rods slowly at first, then insert rods slowly

C. Insert rods slowly during the entire period

D. Insert rods slowly at first, then withdraw rods slowly

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P2359 (B2660)

Which one of the following explains why core Xe-135 oscillations are a concern in a reactor?

A. They can adversely affect core power distribution and can prevent a reactor startup following a reactor trip.

B. They can adversely affect core power distribution and can require operation below full rated power.

C. They can cause rapid reactor power changes during power operation and can prevent a reactor startup following a reactor trip.

D. They can cause rapid reactor power changes during power operation and can require operation below full rated power.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P2360 (B2361)

A reactor had been operating at 70% power for two weeks when power was increased to 100% over a 2-hour period. To offset Xe-135 reactivity changes during the next 12 hours, which one of the following incremental control rod manipulations will be required?

A. Withdraw rods slowly during the entire period.

B. Withdraw rods slowly at first, then insert rods slowly.

C. Insert rods slowly during the entire period.

D. Insert rods slowly at first, then withdraw rods slowly.

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P2559 (B2561)

A reactor is initially operating at 100% power with equilibrium core xenon-135. Power is decreased to 50% over a 2 hour period and average reactor coolant temperature is adjusted to 572°F using manual rod control. Rod control is left in Manual and no subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes the average reactor coolant temperature 10 hours after the power change is completed?

A. Greater than 572°F and decreasing slowly

B. Greater than 572°F and increasing slowly

C. Less than 572°F and decreasing slowly

D. Less than 572°F and increasing slowly

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P2760

A reactor is initially operating at 80% power with equilibrium core xenon-135. Power is increased to 100% over a 2-hour period and average reactor coolant temperature is adjusted to 585°F using manual rod control. Rod control is left in Manual and no subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes the average reactor coolant temperature 24 hours after the power change is completed?

A. Greater than 585°F and decreasing slowly

B. Greater than 585°F and increasing slowly

C. Less than 585°F and decreasing slowly

D. Less than 585°F and increasing slowly

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.06 [3.2/3.4]
QID: P3460

A reactor is initially operating at 100% power with equilibrium core xenon-135. Power is decreased to 40% over a 2 hour period and average reactor coolant temperature is adjusted to 562°F using manual rod control. Rod control is left in Manual and no subsequent operator actions are taken.

If only the reactivity effects of core xenon-135 changes are considered, which one of the following describes the status of the average reactor coolant temperature 2 hours after the power change is completed?

A. Greater than 562°F and decreasing slowly

B. Greater than 562°F and increasing slowly

C. Less than 562°F and decreasing slowly

D. Less than 562°F and increasing slowly

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.07 [3.4/3.4]
QID: P260 (B459)

Two identical reactors have been operating at a constant power level for one week. Reactor A is at 50% power and reactor B is at 100% power.

If both reactors trip/scram at the same time, Xe-135 will peak first in reactor ______ and the <u>highest</u> Xe-135 reactivity peak will occur in reactor ______.

A. A; B

B. A; A

C. B; B

D. B; A

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.07 [3.4/3.4]
QID: P1159 (B1761)

Two identical reactors have been operating at a constant power level for one week. Reactor A is at 100% power and reactor B is at 50% power.

If both reactors trip/scram at the same time, Xe-135 will peak first in reactor ______ and the <u>highest</u> Xe-135 reactivity peak will occur in reactor ______.

A. A; B

B. A; A

C. B; B

D. B; A

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.07 [3.4/3.4]
QID: P1358 (B1361)

A reactor has been operating at 75% power for two months. A manual reactor trip is required for a test. The trip will be followed immediately by a reactor startup with criticality scheduled to occur 12 hours after the trip.

The greatest assurance that xenon reactivity will permit criticality during the startup will be attained if the reactor is operated at ____________ power for 48 hours prior to the trip and if criticality is rescheduled for ____________ hours after the trip.

A. 100%; 8

B. 100%; 16

C. 50%; 8

D. 50%; 16

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.07 [3.4/3.4]
QID: P1561 (B1561)

Select the combination below that completes the following statement.

The amount of control rod withdrawal needed to compensate for peak core xenon-135 negative reactivity will be <u>smallest</u> after a reactor scram from equilibrium _______ reactor power at the _______ of core life.

A. 20%; beginning

B. 20%; end

C. 100%; beginning

D. 100%; end

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.07 [3.4/3.4]
QID: P1660

Select the combination below that completes the following statement.

The amount of control rod withdrawal needed to compensate for peak core xenon-135 negative reactivity will be greatest after a reactor scram from equilibrium _______ reactor power at the _______ of core life.

A. 20%; beginning

B. 20%; end

C. 100%; beginning

D. 100%; end

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.07 [3.4/3.4]
QID: P3860 (B3861)

A reactor has been operating at 80% power for two months. A manual reactor trip is required for a test. The trip will be followed by a reactor startup with criticality scheduled to occur 24 hours after the trip.

The greatest assurance that xenon reactivity will permit criticality during the reactor startup will be attained if the reactor is operated at ____________ power for 48 hours prior to the trip and if criticality is rescheduled for ____________ hours after the trip.

A. 60%; 18

B. 60%; 30

C. 100%; 18

D. 100%; 30

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P62

Slow changes in axial power distribution in a reactor that has operated at a steady-state power for a long time can be caused by xenon...

A. peaking.

B. override.

C. burnup.

D. oscillation.

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P261

Xenon oscillations that tend to <u>dampen</u> themselves toward equilibrium over time are _______________ oscillations.

A. converging

B. diverging

C. diffusing

D. equalizing

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P372

Which one of the following occurrences can cause reactor power to fluctuate between the top and bottom of the core when steam demand is constant?

A. Steam generator level transients

B. Iodine spiking

C. Xenon oscillations

D. Inadvertent boron dilution

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P463 (N/A)

A reactor has been operating at 100% power for several weeks with a symmetrical axial power distribution that is peaked at the core midplane. Reactor power is reduced to 50% using boration to control reactor coolant temperature while maintaining control rods fully withdrawn.

During the power reduction, the axial power distribution will...

A. shift toward the top of the core.

B. shift toward the bottom of the core.

C. peak at the top and the bottom of the core.

D. remain symmetrical and peaked at the core midplane.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P563 (N/A)

A reactor is operating at 100% power at the beginning of core life with equilibrium core xenon-135. Reactor power is reduced, within a 2 hour period, to 50%. Control rods are maintained fully withdrawn. The following parameter values are given:

	PRIOR TO POWER CHANGE	AFTER POWER CHANGE
Reactor power:	100%	50%
Reactor coolant system boron concentration:	740 ppm	820 ppm
Control rod position:	Fully Withdrawn	Fully Withdrawn

What is the effect on power distribution in the core during the first 4 hours following the power reduction?

A. Power production in the top of the core increases relative to the bottom of the core.

B. Power production in the top of the core decreases relative to the bottom of the core.

C. There is no relative change in power distribution in the core.

D. It is impossible to determine without additional information.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P761

When a reactor experiences xenon oscillations, the most significant shifts in power generation occur between the ________________ of the core.

A. top and bottom

B. adjacent quadrants

C. center and periphery

D. opposite quadrants

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P763 (N/A)

A reactor has been operating at 80% power for several weeks with power production equally distributed axially above and below the core midplane. Reactor power is increased to 100% using boron dilution to control reactor coolant temperature while maintaining control rods fully withdrawn.

During the power increase, axial power distribution will...

A. shift toward the top of the core.

B. shift toward the bottom of the core.

C. remain evenly distributed above and below the core midplane.

D. peak at the top and the bottom of the core.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P961

Which one of the following will cause reactor power to fluctuate slowly between the top and bottom of the core with steady state steam demand?

A. Feedwater variations

B. Dropped center control rod

C. Xenon oscillation

D. Samarium oscillation

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P1160

Xenon-135 oscillations take about ____________ hours to get from maximum xenon-135 negative reactivity to minimum xenon-135 negative reactivity.

A. 40 to 50

B. 24 to 28

C. 12 to 14

D. 6 to 7

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P2764 (N/A)

A reactor is operating at 80% power at the beginning of core life with equilibrium core xenon-135. Reactor power is increased, over a 2-hour period, to 100%. The following information is provided:

	PRIOR TO POWER CHANGE	AFTER POWER CHANGE
Reactor power:	80%	100%
Reactor coolant system boron concentration:	780 ppm	760 ppm
Control rod position:	Fully Withdrawn	Fully Withdrawn

What is the effect on power distribution in the core during the first 4 hours following the power increase?

A. Power production in the top of the core increases relative to the bottom of the core.

B. Power production in the top of the core decreases relative to the bottom of the core.

C. There is no relative change in power distribution in the core.

D. It is impossible to determine without additional information.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.08 [3.3/3.4]
QID: P3060 (B3061)

A reactor has been operating at full power for one month following a refueling outage with core axial neutron flux distribution peaked in the bottom half of the core. An inadvertent reactor scram occurs. The reactor is restarted, with criticality occurring 6 hours after the scram. Reactor power is increased to 60% over the next 4 hours and stabilized.

How will core axial neutron flux distribution be affected during the 1-hour period immediately following the return to 60% power?

The core axial neutron flux peak will be located _______ in the core than the pre-scram peak location, and the flux peak will be moving ________.

A. higher; downward

B. higher; upward

C. lower; downward

D. lower; upward

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.09 [3.0/3.1]
QID: P353 (B355)

A nuclear plant is being returned to operation following a refueling outage. Fuel preconditioning requires reactor power to be increased from 10% to full power gradually over a one week period.

During this slow power increase, most of the positive reactivity added by the operator is required to overcome the negative reactivity from...

A. fuel burnup.

B. xenon buildup.

C. fuel temperature increase.

D. moderator temperature increase.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.09 [3.0/3.1]
QID: P1263

A reactor has been shut down for seven days to perform maintenance. A reactor startup is performed and power is ramped to 50% over a 5-hour period.

When power reaches 50%, the magnitude of core xenon negative reactivity will be...

A. increasing toward a peak.

B. increasing toward equilibrium.

C. decreasing toward equilibrium.

D. decreasing toward a valley.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.09 [3.0/3.1]
QID: P1661

A reactor has been shut down for 5 days to perform maintenance. A reactor startup is performed and power is ramped to 75% over a 16 hour period.

When power reaches 75%, the concentration of core xenon-135 will be...

A. decreasing toward an upturn.

B. increasing toward a peak value.

C. decreasing toward an equilibrium value.

D. increasing toward an equilibrium value.

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.10 [3.1/3.2]
QID: P128

A reactor startup is being performed 5 hours after a reactor scram from 100% equilibrium power. The plant is being returned to rated power at 2.0%/minute instead of the normal rate of 0.5%/minute.

At the faster rate of power increase, the <u>minimum</u> amount of core xenon will occur ____________ and the amount of equilibrium core xenon will be ____________.

A. sooner; the same

B. sooner; smaller

C. later; the same

D. later; smaller

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.10 [3.1/3.2]
QID: P1062

A reactor has been operating at 100% power for eight weeks when a reactor trip occurs. The reactor is critical 6 hours later and power is increased to 100% over the next 6 hours.

What is the status of core xenon-135 concentration when power reaches 100%?

A. Increasing toward an equilibrium value.

B. Burning out faster than it is being produced.

C. Increasing toward a peak value.

D. At equilibrium.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.10 [3.1/3.2]
QID: P1262

Xenon poisoning in a reactor core is most likely to prevent a reactor startup following a reactor shutdown from ____________ power at the ____________ of core life.

A. high; beginning

B. low; beginning

C. high; end

D. low; end

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.11 [3.1/3.1]
QID: P63

A reactor that has been operating at rated power for two weeks is quickly reduced in power to 50%. Xenon-135 will reach a new equilibrium condition in ______________ hours.

A. 8 to 10

B. 20 to 25

C. 30 to 35

D. 40 to 50

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.11 [3.1/3.1]
QID: P263

A reactor that has been operating at rated power for about two weeks is reduced in power to 50%. What happens to the Xe-135 concentration in the core?

A. There will be no change because iodine concentration is constant.

B. Xenon will initially build up, then decrease to a new equilibrium value.

C. Xenon will initially decrease, then build up to a new equilibrium value.

D. Xenon will steadily decrease to a new equilibrium value.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.11 [3.1/3.1]
QID: P1860 (B2259)

Which one of the following describes the change in core xenon-135 concentration immediately following a power increase from equilibrium conditions?

A. Initially decreases due to the increased rate of xenon-135 radioactive decay.

B. Initially decreases due to the increased absorption of thermal neutrons by xenon-135.

C. Initially increases due to the increased xenon-135 production from fission.

D. Initially increases due to the increased iodine-135 production from fission.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.11 [3.1/3.1]
QID: P2261 (B2761)

A reactor has been operating at steady-state 50% power for 12 hours following a one-hour power reduction from steady-state 100% power. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak

B. Decreasing toward an upturn

C. Increasing toward equilibrium

D. Decreasing toward equilibrium

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.11 [3.1/3.1]
QID: P2762 (B2763)

A reactor that had been operating at 100% power for about two months was shutdown over a 2-hour period. Following the shutdown, core xenon-135 will reach a long-term steady-state concentration in ______________ hours.

A. 8 to 10

B. 20 to 25

C. 40 to 50

D. 70 to 80

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.11 [3.1/3.1]
QID: P2961 (B2960)

A reactor has been operating at steady-state 30% power for 3 hours following a one-hour power reduction from steady-state 100% power. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak

B. Decreasing toward an upturn

C. Increasing toward equilibrium

D. Decreasing toward equilibrium

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.11 [3.1/3.1]
QID: P3261

A reactor plant is initially operating at equilibrium 100% power in the middle of a fuel cycle. The operators decrease main generator load while adding boric acid to the RCS over a period of 30 minutes. At the end of this time period, reactor power is 70% and average reactor coolant temperature is 575°F. All control rods remain fully withdrawn and in manual control.

Given:

Total reactivity added by operator = -3.3×10^{-3} ΔK/K
Total power coefficient = -1.1×10^{-4} ΔK/K/% power

Assuming no additional RCS boration occurs and no other operator actions are taken, what will average reactor coolant temperature be after an additional 60 minutes?

A. 575°F and stable

B. Less than 575°F and increasing

C. Less than 575°F and decreasing

D. Less than 575°F and stable

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.11 [3.1/3.1]
QID: P3362 (B2559)

A reactor has been operating at 70% power for 26 hours following a one-hour power reduction from steady-state 100% power. Which one of the following describes the current core xenon-135 concentration?

A. At equilibrium

B. Increasing toward a peak

C. Decreasing toward an upturn

D. Decreasing toward equilibrium

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.12 [3.1/3.1]
QID: P360

Compare a reactor that has been operating at 50% power for several days when a reactor trip occurs, to a reactor that had been operating at full power prior to the trip. For the 50% power reactor, xenon would peak _____________ and the peak xenon reactivity would be ______________.

A. earlier; the same

B. at the same time; the same

C. earlier; less negative

D. at the same time; less negative

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.12 [3.1/3.1]
QID: P663

Following a reactor trip, negative reactivity from xenon initially increases due to...

A. xenon production from the decay of iodine-135.

B. xenon production from the spontaneous fission of uranium.

C. the reduction of xenon removal by decay.

D. the reduction of xenon removal by recombination.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.12 [3.1/3.1]
QID: P863 (B2262)

Twenty-four hours after a reactor trip from a long-term, steady-state, rated-power run, the core xenon-135 concentration will be approximately...

A. the same as at the time of the trip and decreasing.

B. the same as at the time of the trip and increasing.

C. 50% lower than at the time of the trip and decreasing.

D. 50% higher than at the time of the trip and increasing.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.12 [3.1/3.1]
KNOWLEDGE: K1.13 [2.9/3.0]
QID: P963

A reactor has been operating at full power for several days when it is shut down rapidly (within 2 hours) for maintenance. How will core xenon reactivity change?

A. Peak in 2 to 4 hours and then decay to near zero in about 1 day.

B. Peak in 2 to 4 hours and then decay to near zero in 3 to 4 days.

C. Peak in 6 to 10 hours and then decay to near zero in about 1 day.

D. Peak in 6 to 10 hours and then decay to near zero in 3 to 4 days.

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.12 [3.1/3.1]
QID: P1063 (B2159)

A reactor has been operating at 100% power for three weeks when a reactor trip occurs. Which one of the following describes the concentration of Xe-135 in the core 24 hours after the trip?

A. At least 2 times the concentration at the time of the trip and decreasing

B. Less than 1/2 the concentration at the time of the trip and decreasing

C. At or approaching a peak value

D. Approximately the same as at the time of the trip

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.12 [3.1/3.1]
QID: P2262 (B2461)

Fourteen hours after a reactor trip from 100% power equilibrium xenon conditions, the amount of core xenon-135 will be...

A. lower than 100% equilibrium xenon, and will have added a net positive reactivity since the trip.

B. lower than 100% equilibrium xenon, and will have added a net negative reactivity since the trip.

C. higher than 100% equilibrium xenon, and will have added a net positive reactivity since the trip.

D. higher than 100% equilibrium xenon, and will have added a net negative reactivity since the trip.

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.12 [3.1/3.1]
QID: P2363

How does core xenon-135 change immediately following a reactor trip from equilibrium 100% power operation?

A. Decreases due to xenon removal by decay.

B. Decreases due to the reduction in xenon production directly from fission.

C. Increases due to xenon production from the decay of iodine-135.

D. Increases due to xenon production from the spontaneous fission of uranium.

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.12 [3.1/3.1]
QID: P2662 (B2662)

Given:

- A reactor had been operating at 100% power for six weeks when a reactor trip occurred.
- A reactor startup was performed and criticality was reached 16 hours after the trip.
- Two hours later, the reactor is steady at 30% power with control rods in Manual.

If no operator actions are taken over the next hour, average reactor coolant temperature will ___________ because core Xe-135 concentration is ___________.

A. increase; decreasing

B. increase; increasing

C. decrease; decreasing

D. decrease; increasing

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.12 [3.1/3.1]
QID: P2862 (B1462)

A reactor scram has occurred following two months operation at steady-state 100% power. How soon after the scram will the reactor first be considered xenon-free?

A. 8 to 10 hours

B. 24 to 30 hours

C. 40 to 50 hours

D. 70 to 80 hours

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.13 [2.9/3.0]
QID: P562

After a reactor shutdown from equilibrium core xenon conditions, the maximum xenon -135 negative reactivity (height of the xenon peak) is _______________ preshutdown equilibrium power level.

A. independent of

B. exactly proportional to

C. inversely proportional to

D. dependent on but not exactly proportional to

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.13 [2.9/3.0]
QID: P1760

A nuclear plant was shut down following three months of operation at full power. The shutdown occurred over a 3 hour period with a constant rate of power decrease.

Which one of the following describes the reactivity added by core xenon during the shutdown?

A. Xenon buildup added negative reactivity.

B. Xenon buildup added positive reactivity.

C. Xenon burnout added negative reactivity.

D. Xenon burnout added positive reactivity.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P262

Four hours after a reactor trip from equilibrium full power operation, a reactor is taken critical and power is immediately stabilized for critical data. To maintain a constant reactor power, the operator must add __________ reactivity because core Xe-135 concentration is __________.

A. positive; increasing

B. positive; decreasing

C. negative; increasing

D. negative; decreasing

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P361 (B1862)

A plant has been operating at 100% power for two months when a reactor scram occurs. Shortly after the reactor scram a reactor startup is commenced. Six hours after the scram, reactor power is at 2%. To maintain power stable at 2% over the next hour, the operator must add...

A. positive reactivity because core xenon-135 is building up.

B. negative reactivity because core xenon-135 is building up.

C. positive reactivity because core xenon-135 is decaying away.

D. negative reactivity because core xenon-135 is decaying away.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P561 (B562)

Following a seven day shutdown, a reactor startup is performed and a plant is taken to 100% power over a 16-hour period. After reaching 100% power, what type of reactivity will the operator need to add to compensate for core xenon-135 changes over the next 24 hours?

A. Negative only

B. Negative, then positive

C. Positive only

D. Positive, then negative

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P1462 (B1461)

A reactor has been operating at 100% power for two weeks. Power is then decreased over a 1-hour period to 10%.

Assuming manual rod control, which one of the following operator actions is required to maintain a constant reactor coolant temperature at 10% power during the next 24 hours?

A. Add negative reactivity during the entire period

B. Add positive reactivity during the entire period

C. Add positive reactivity, then negative reactivity

D. Add negative reactivity, then positive reactivity

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P1762 (B1763)

A reactor startup is being conducted and criticality has been achieved 15 hours after a reactor scram from long term operation at full power. After 1 additional hour, reactor power is stabilized at 10^{-4}% power and all control rod motion is stopped.

Which one of the following describes the response of reactor power over the next 2 hours without any further operator actions?

A. Power increases toward the point of adding heat due to the decay of Xe-135.

B. Power increases toward the point of adding heat due to the decay of Sm-149.

C. Power decreases toward the shutdown neutron level due to the buildup of Xe-135.

D. Power decreases toward the shutdown neutron level due to the buildup of Sm-149.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P2260

A reactor is initially shut down with no xenon in the core. Over the next four hours, the reactor is made critical and power level is increased to the point of adding heat. The shift supervisor has directed that power be maintained constant at this level for 12 hours for testing.

To accomplish this objective, control rods will have to be...

A. inserted periodically for the duration of the 12 hours.

B. withdrawn periodically for the duration of the 12 hours.

C. inserted periodically for 4 to 6 hours, then withdrawn periodically.

D. withdrawn periodically for 4 to 6 hours, then inserted periodically.

ANSWER: B.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P2561

A reactor is initially shut down with no xenon in the core. A reactor startup is performed and 4 hours later power level is at 25%. The shift supervisor has directed that reactor power and reactor coolant temperature be maintained constant at this level for 12 hours.

To accomplish this, control rods will have to be...

A. withdrawn periodically for the duration of the 12 hours.

B. inserted periodically for the duration of the 12 hours.

C. withdrawn periodically for 4 to 6 hours, then inserted periodically.

D. inserted periodically for 4 to 6 hours, then withdrawn periodically.

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P2863

A reactor is operating at 100% power immediately following a one-hour power ascension from steady-state 70% power. To keep reactor coolant system temperature stable over the next two hours, the operator must ________ control rods or _________ reactor coolant boron concentration.

A insert; increase

B. insert; decrease

C. withdraw; increase

D. withdraw; decrease

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P2963 (B2964)

A reactor is operating at 60% power immediately after a one-hour power increase from equilibrium 40% power. To keep RCS T-avg stable over the next two hours, the operator must ________ control rods or _________ reactor coolant boron concentration.

A. insert; increase

B. insert; decrease

C. withdraw; increase

D. withdraw; decrease

ANSWER: A.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P3063

A reactor plant is initially operating at 100% power with equilibrium core xenon-135. Power is decreased to 75% over a 1-hour period and then stabilized. The operator then adjusts control rod height as necessary to maintain average reactor coolant temperature constant.

What will be the rod position and directional trend 30 hours after the power change?

A. Above the initial 75% power position and inserting slowly

B. Above the initial 75% power position and withdrawing slowly

C. Below the initial 75% power position and inserting slowly

D. Below the initial 75% power position and withdrawing slowly

ANSWER: C.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P3563 (B3563)

A plant had been operating at 100% power for two months when a reactor trip occurred. Soon afterward, a reactor startup was performed. Twelve hours after the trip, the startup has been paused with reactor power at 2%.

To maintain reactor power and reactor coolant temperature stable over the next hour, the operator must add ___________ reactivity because core xenon-135 concentration will be _____________.

A. positive; increasing.

B. negative; increasing.

C. positive; decreasing.

D. negative; decreasing.

ANSWER: D.

TOPIC: 192006
KNOWLEDGE: K1.14 [3.2/3.3]
QID: P3863

A nuclear power plant is initially operating at steady-state 100% reactor power in the middle of a fuel cycle. The operators then slowly decrease main generator load to 90% while adding boric acid to the RCS. After the required amount of boric acid is added, reactor power is 90% and average reactor coolant temperature is 582°F. All control rods remain fully withdrawn and in manual control.

Assuming no other operator actions are taken, which one of the following describes the average reactor coolant temperature after an additional 60 minutes?

A. Higher than 582°F and increasing slowly.

B. Higher than 582°F and decreasing slowly.

C. Lower than 582°F and increasing slowly.

D. Lower than 582°F and decreasing slowly.

ANSWER: D.